

THE CLAIMS

What is claimed is:

1. An integrated circuit package comprising:

5 a plurality of circuitry wafers each comprising a non-electrically conductive substrate on which is carried one or more integrated circuits with at least one wafer configured for signal communication outside the package; and

a plurality of non-electrically conductive cooling plates alternately layered with the circuitry wafers;

10 wherein the circuitry wafers and cooling plates are layered in a first direction that defines a first axis of the package, and wherein signal communication between circuitry wafers within the package occurs in a direction along the first axis;

wherein the cooling plates are configured to direct heat flow in a path that is transverse to the first axis; and

15 wherein at least one of power, data signal and control signal communication is supplied to the package from a direction that is transverse to both the first axis and the direction of heat flow.

20 2. The package of claim 1 comprising cooling plates that define flow conduits there-through for coolant fluid, wherein each flow conduit has two conduit ends and wherein the conduit ends are aligned at two different positions on the side of the package, and wherein the package further comprises manifolds that provide a port through which to provide coolant fluid to a plurality of flow conduits and a port to collect coolant fluid from a plurality of flow conduits, and wherein the manifolds are configured to permit access to the side of the package for 25 providing at least one of power, data signal and control signal communication to circuitry wafers in the package.

3. An integrated circuit package comprising:

30 a plurality of circuitry wafers each comprising a non-electrically conductive substrate on which is carried one or more integrated circuits with at least one circuitry wafer configured for signal communication outside the package; and

a plurality of non-electrically conductive cooling plates alternately layered with the circuitry wafers;

and comprising circuitry wafers and cooling plates configured so that integrated circuits on at least two circuitry wafers in the package communicate with each other through an intervening cooling plate.

5 4. The package of claim 3 comprising cooling plates that define flow conduits therethrough for coolant fluid, wherein each flow conduit has two conduit ends and wherein the conduit ends are aligned at two different sides of the package, and wherein the package further comprises manifolds that each provide a port through which to provide coolant fluid to a plurality of flow conduits and a port to collect cooling fluid from a plurality of flow conduits.

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5. The package of claim 3 wherein the manifolds are configured to permit access to the side of the package for providing power and/or control signals to circuitry wafers in the package.

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6. The package of any one of claims 1-3 wherein at least one cooling plate comprises a plate signal path therethrough and wherein a first IC on a circuitry wafer on one side of the cooling plate is positioned for signal communication through the plate signal path.

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7. The package of claim 6 comprising a second IC on a circuitry wafer on the other side of the cooling plate, positioned for signal communication with the first IC through the plate signal path.

8. The package of claim 6 wherein the first IC is an optical IC and wherein the plate signal path comprises a plate optical signal path.

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9. The package of claim 8 comprising a second optical IC on a circuitry wafer on the other side of the cooling plate, positioned for optical signal communication with the first optical IC through the plate optical signal path.

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10. The package of any one of claims 1-3 wherein at least one circuitry wafer comprises a substrate having a substrate signal path therethrough and wherein a first IC is positioned on the substrate for signal communication therethrough.

11. The package of claim 9 comprising a second IC on a substrate positioned for signal communication with the first IC via the substrate signal path.
12. The package of claim 10 wherein the first IC comprises an optical IC and wherein 5 the substrate signal path comprises a substrate optical signal path.
13. The package of claim 12 comprising a second optical IC on a substrate positioned for optical signal communication with the first optical IC via the substrate optical signal path.
14. The package of any one of claims 3-5 wherein the circuitry wafers and cooling plates are layered in a first direction along a first axis, and wherein the circuitry wafers and cooling plates are configured to permit signal communication between circuitry wafers within the package in a direction along the first axis;
wherein the cooling plates are configured to direct heat flow in a path that is transverse to the first axis; and
wherein at least one of power, data signal communication and control signal communication are supplied to the package from a direction that is transverse to both the first axis and the direction of heat flow.